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(54) Ink jet apparatus and Ink jet cartridge therefor.

(57) An ink cartridge detachably mountable to an ink jet recording apparatus, the ink cartridge containing ink to be supplied to a recording head includes an ink container for containing the ink; and an adaptor having a receptor for detachably receiving the ink

container and an information medium for storing information relating to the ink, the information being transmitted to the ink jet recording apparatus when the ink cartridge is mounted therein.

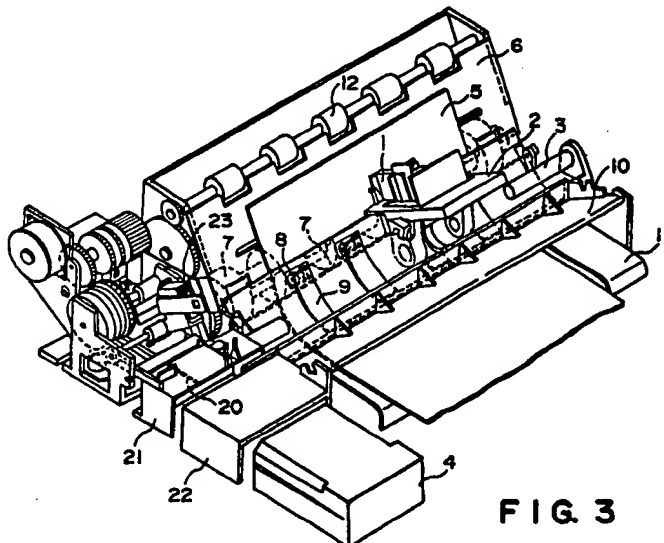


FIG. 3

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developed in the future, it is still not usable because the program in the apparatus is not always proper. In order to solve such problems, some proposals have been made. For example, there is a proposal that the user sets the hardware or the software in accordance with the material of the ink. This is good in that the control parameters of the ink jet recording apparatus can be finely selected in accordance with the material of the ink. However, there are a great number of parameters to be selected, and therefore, the selecting operation is cumbersome. In addition, if the setting is erroneous, the proper printing is not effected, or the recording head experiences the overload. Therefore, the reliability is not sufficient.

In another proposal, the ink cartridge is provided with information medium (a resistor element, magnetic medium, bar-code, IC or ROM, for example) bearing information relating to the control parameters for the ink jet recording apparatus, so that the ink jet recording apparatus can automatically select the proper parameters in accordance with the information. According to this proposal, the information peculiar to the ink contained in the ink cartridge is assuredly transmitted to the main assembly of the recording apparatus, and the proper recording operation is guaranteed, and therefore, it is very good. However, it requires that a relatively expensive information medium such as a semiconductor memory means is provided for each of the cartridges, results in the increase of the cost of the ink cartridge. Furthermore, in order to permit the information to be read from the information medium into the ink jet recording head, a number of connections (for example, ROM) which are required to be correctly connected with the corresponding electrodes in the main assembly. Therefore, the mechanical accuracy has to be enhanced in the relative positional relations between the main assembly of the apparatus and the ink jet cartridge.

#### SUMMARY OF THE INVENTION

Accordingly, it is a principal object of the present invention to provide an improved structure for the transmission of the information from the ink cartridge to the main assembly of the recording apparatus.

It is another object of the present invention to provide an ink jet recording apparatus and an ink jet cartridge wherein the control parameters of the ink jet recording apparatus can be correctly and easily changed in accordance with the material of the ink contained.

It is a further object of the present invention to provide an ink jet recording apparatus and an ink cartridge structure wherein the high quality recording operation is possible with an increased reliability.

ity.

According to an aspect of the present invention, there is provided an ink cartridge detachably mountable to an ink jet recording apparatus, said ink cartridge containing ink to be supplied to a recording head, comprising: an ink container for containing the ink; and an adaptor having a receptor for detachably receiving said ink container and an information medium for storing information relating to the ink, the information being transmitted to said ink jet recording apparatus when said ink cartridge is mounted therein.

According to another aspect of the present invention, there is provided an ink jet apparatus, comprising: an ink supply system for supplying ink from an ink cartridge containing the ink to be supplied to a recording head to the recording head; a recovery system for maintaining and recovering ink ejection from the recording head; a receptor to which the ink jet cartridge is detachably mountable; wherein said receptor is provided with a contact for electric contact with an information medium of the ink cartridge to read the information, wherein the ink cartridge comprises an ink container containing the ink and an adaptor having a receptor for the ink container and the information medium bearing the information relating to the ink.

According to an aspect of the present invention, only an ink cassette is taken out of the ink cartridge after the ink is used up, and is exchanged with a fresh one, leaving an adaptor having the information medium bearing the information representative of the property of the ink in the ink cassette. Therefore, the adaptor can be continued to be used.

The ink cassette and the adaptor so related, that only the proper ink cassette can be set in the adaptor. Therefore, the information relating to the ink is correctly and assuredly transmitted to the recording apparatus. Therefore, even in the ink cartridge in which the ink cassette is exchanged, the recording head can be properly driven in accordance with the property of the ink in the exchanged ink cassette.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a sectional view of a recording head of a bubble jet type.

Figure 2 is a graph of changes with time of the surface temperature of the heat acting surface and a volume of a produced bubble when a pulse

is supported on that side of the adaptor 26 which is for the connection with the apparatus. The recording medium is capable of electrically or electronically storing the information. It may be in the form of a ROM, an electrically erasable ROM, a resistor, a capacitor, a battery, a battery backed-up RAM, logic circuit or the like.

The information medium may store physical memory, for example, by providing a particular configuration to the adaptor 26, by different optical reflecting or transparent properties, by magnetic recording. In these cases, the ink jet recording apparatus is provided with an information reading means corresponding thereto.

The information medium 32 bears information necessary for the control for the main assembly of the ink jet recording apparatus in accordance with the material of the ink accommodated in the ink cassette 25. Designated by a reference 32A is a contact of the information medium 32 to establish the electric connection between the information medium 32 and the main assembly of the ink jet recording apparatus. The contact 32A has contact elements disposed at a high density, and therefore, it can be accommodated in a small area. A rail 33 is formed at each side of the adaptor 26. When the ink cartridge 4 is inserted through the insertion inlet 21 along the cartridge guide 22, the rails 33 are engaged with unshown guiding grooves, by which the ink cartridge 4 is correctly positioned, and in addition, the correct relative position between the information medium and the leading means is assured.

In addition, in this embodiment, the capping member 31 of the ink cassette 25 which is connected with the supplying hollow needle 20 is in the form of a projection, and when the ink cassette 25 is mounted in the adaptor 26, the wall surface 25A of the portion constitutes a side wall of the adaptor.

Adjacent the capping member 31, there is an opening 44 to accept a residual ink tube 42 of the apparatus for the ink absorbing material 28 for absorbing the residual ink. The opening 44 is overlapped with a residual ink recepting opening 43 of the adaptor 26 when the ink cassette 25 is mounted in the adaptor 26.

The opening 44 may be formed so as to be larger than the opening 43, as shown in Figure 4. It may have the same size and configuration as the opening 43, if it can properly receive the residual ink.

A fixed or replaceable absorbing material may be provided at the regions adjacent the front surface 25b of the ink cassette 25 and the inside surface 26b of the adaptor 26 for receiving the residual ink, in order to prevent the leakage of the residual ink.

In addition, the opening 44 may be provided with a film or a sheet-like covering member which may be broken by a tube 42 when the ink cartridge is mounted to the assembly. By doing so, the residual ink may be discharged. The covering member may be provided with a slit at a position where the tube is inserted. The provision of the covering member is effective to prevent the scattering of the residual ink when the residual ink flows and the falling of the residual ink from the residual ink absorbing material upon the exchange of the ink cassette after the use-up thereof.

In the ink cartridge 4 described in the foregoing, the fitting between the recess 29 of the ink cassette and the projection 30 of the adaptor 26 is predetermined in accordance with the material of the ink contained in the ink cassette 25. The information medium 32 of the adaptor 26 bears information for the controlling operation of the main assembly of the recording apparatus suitable for the material of the ink contained in the ink cassette 25. Therefore, the ink cassette 25 of one kind is usable only with the adaptor 26 having the information medium 32 corresponding to the control information suitable for the material of the ink contained in the cassette.

By using the two part structure including the ink cassette containing the ink and the adaptor for accommodating the cassette, the operator is required only to set a fresh ink cassette into the adaptor after the ink is used up. The adaptor is reusable so that the running cost can be reduced. Since the information medium for transmitting the information is not exchanged, and therefore, the accuracy in the connection with the main assembly can be sufficiently maintained.

Figure 5 shows the state wherein the ink cartridge 4 including the ink cassette 25 and the adaptor 26 is mounted in the ink cartridge receptor of the ink jet recording apparatus of Figure 4. Here, the precise engagement is established between the rails 33 of the adaptor 26 and the guides 41 in the cartridge inserting inlet 21 of the ink jet recording apparatus, and when the ink cartridge 4 is inserted in the direction of the arrow, the capping member 31 is pierced with the hollow ink needle 20 disposed at the receptor 40 of the ink jet recording apparatus, so that the ink in the ink bag 27 can be supplied to the ink jet recording apparatus.

The ink forcedly ejected from the ink jet recording head 1 by the ink refilling operation, flows through a tube 42 of the main assembly of the recording apparatus and is absorbed by the residual ink absorbing material 28 through the openings 43 and 44. When the ink cartridge 4 is completely mounted in the cartridge receptor 40, the electric connection is established between the contacts 32A and the corresponding connecting pins 45

of the adaptor 36 constituting the ink cartridge 34.

The outer periphery of the ink absorbing material 28 may be covered with a film or sheet material to provide the sealing. If this is done, the operator's hand will not be contaminated upon exchange of the absorbing material 28. Alternatively or in addition, the adaptor may be provided with a partition member for isolating the ink cassette 35 and the residual ink absorbing material 28. By doing so, the sealing can be assured, and the ink cassette 35 may be prevented from being contaminated with the residual ink.

The present invention is particularly suitably usable in a bubble jet recording head and recording apparatus developed by Canon Kabushiki Kaisha, Japan. This is because, the high density of the picture element, and the high resolution of the recording are possible.

The typical structure and the operational principle of preferably the one disclosed in U.S. Patent Nos. 4,723,129 and 4,740,798. The principle is applicable to a so-called on-demand type recording system and a continuous type recording system particularly however, it is suitable for the on-demand type because the principle is such that at least one driving signal is applied to an electrothermal transducer disposed on a liquid (ink) retaining sheet or liquid passage, the driving signal being enough to provide such a quick temperature rise beyond a departure from nucleation boiling point, by which the thermal energy is provided by the electrothermal transducer to produce film boiling on the heating portion of the recording head, whereby a bubble can be formed in the liquid (ink) corresponding to each of the driving signals. By the development and collapse of the bubble, the liquid (ink) is ejected through an ejection outlet to produce at least one droplet. The driving signal is preferably in the form of a pulse, because the development and collapse of the bubble can be effected instantaneously, and therefore, the liquid (ink) is ejected with quick response. The driving signal in the form of the pulse is preferably such as disclosed in U.S. Patents Nos. 4,463,359 and 4,345,282. In addition, the temperature increasing rate of the heating surface is preferably such as disclosed in U.S. Patent No. 4,313,124.

The structure of the recording head may be as shown in U.S. Patent Nos. 4,558,333 and 4,459,600 wherein the heating portion is disposed at a bent portion in addition to the structure of the combination of the ejection outlet, liquid passage and the electrothermal transducer as disclosed in the above-mentioned patents. In addition, the present invention is applicable to the structure disclosed in Japanese Laid-Open Patent Application Publication No. 123670/1984 wherein a common slit is used as the ejection outlet for plural electrothermal trans-

ducers, and to the structure disclosed in Japanese Laid-Open Patent Application No. 138481/1984 wherein an opening for absorbing pressure wave of the thermal energy is formed corresponding to the ejecting portion. This is because, the present invention is effective to perform the recording operation with certainty and at high efficiency irrespective of the type of the recording head.

The present invention is effectively applicable to a so-called full-line type recording head having a length corresponding to the maximum recording width. Such a recording head may comprise a single recording head and a plural recording head combined to cover the entire width.

In addition, the present invention is applicable to a serial type recording head wherein the recording head is fixed on the main assembly, to a replaceable chip type recording head which is connected electrically with the main apparatus and can be supplied with the ink by being mounted in the main assembly, or to a cartridge type recording head having an integral ink container.

The provision of the recovery means and the auxiliary means for the preliminary operation are preferable, because they can further stabilize the effect of the present invention. As for such means, there are capping means for the recording head, cleaning means therefor, pressing or sucking means, preliminary heating means by the ejection electrothermal transducer or by a combination of the ejection electrothermal transducer and additional heating element and means for preliminary ejection not for the recording operation, which can stabilize the recording operation.

As regards the kinds of the recording head mountable, it may be a single corresponding to a single color ink, or may be plural corresponding to the plurality of ink materials having different recording color or density. The present invention is effectively applicable to an apparatus having at least one of a monochromatic mode mainly with black and a multi-color with different color ink materials and a full-color mode by the mixture of the colors which may be an integrally formed recording unit or a combination of plural recording heads.

Furthermore, in the foregoing embodiment, the ink has been liquid. It may be, however, an ink material solidified at the room temperature or below and liquefied at the room temperature. Since in the ink jet recording system, the ink is controlled within the temperature not less than 30 °C and not more than 70 °C to stabilize the viscosity of the ink to provide the stabilized ejection, in usual recording apparatus of this type, the ink is such that it is liquid within the temperature range when the recording signal is applied. In addition, the temperature rise due to the thermal energy is positively prevented by consuming it for the state

mounting thereof relative to said ink cartridge, and wherein the projection also functions as a guiding rail for mounting of said ink cartridge.

10. An apparatus according to Claim 3, wherein a side wall of said cassette is provided with a projection for facilitating mounting or dismounting of said cassette relative to said ink cartridge, and wherein said projection also functions as a member for limiting a position thereof relative to said ink jet recording apparatus.
11. An apparatus according to Claim 3, wherein an ink collecting portion of said cassette is provided with an opening which is covered with a sheet for preventing external leakage of the ink, and a slit is formed to permit insertion of an ink tube therethrough.
12. An apparatus according to Claim 1, wherein the information medium bears information relating to a driving condition of said recording head.
13. An ink jet apparatus, comprising:
  - an ink supply system for supplying ink from an ink cartridge containing the ink to be supplied to a recording head to the recording head;
  - a recovery system for maintaining and recovering ink ejection from the recording head;
  - a receptor to which the ink jet cartridge is detachably mountable;
  - wherein said receptor is provided with a contact for electric contact with an information medium of the ink cartridge to read the information, wherein the ink cartridge comprises an ink container containing the ink and an adaptor having a receptor for the ink container and the information medium bearing the information relating to the ink.
14. An apparatus according to Claim 13, further comprising drive control means for driving the recording head in accordance with the information read.
15. An apparatus according to Claim 13, wherein said ink cartridge receptor is provided with a guiding member contactable with a projection formed on a side wall of a cassette including the ink container and an ink absorbing material, the projection being effective to facilitate mounting and dismounting of the cassette relative to the ink cartridge and also effective to limit an insertion position relative to said ink jet recording apparatus.
16. An apparatus according to Claim 13, wherein said ink cartridge receptor is provided with a guiding member engageable with a projection formed on a side wall of a cassette including said ink container and an ink absorbing material, said projection being effective to facilitate mounting and dismounting of said cassette relative to said ink cartridge and also effective to guide said ink cartridge relative to said ink cartridge receptor.
17. An apparatus according to Claim 13, wherein the recording head is provided with an electrothermal transducer for producing thermal energy to produce a bubble to eject the ink.

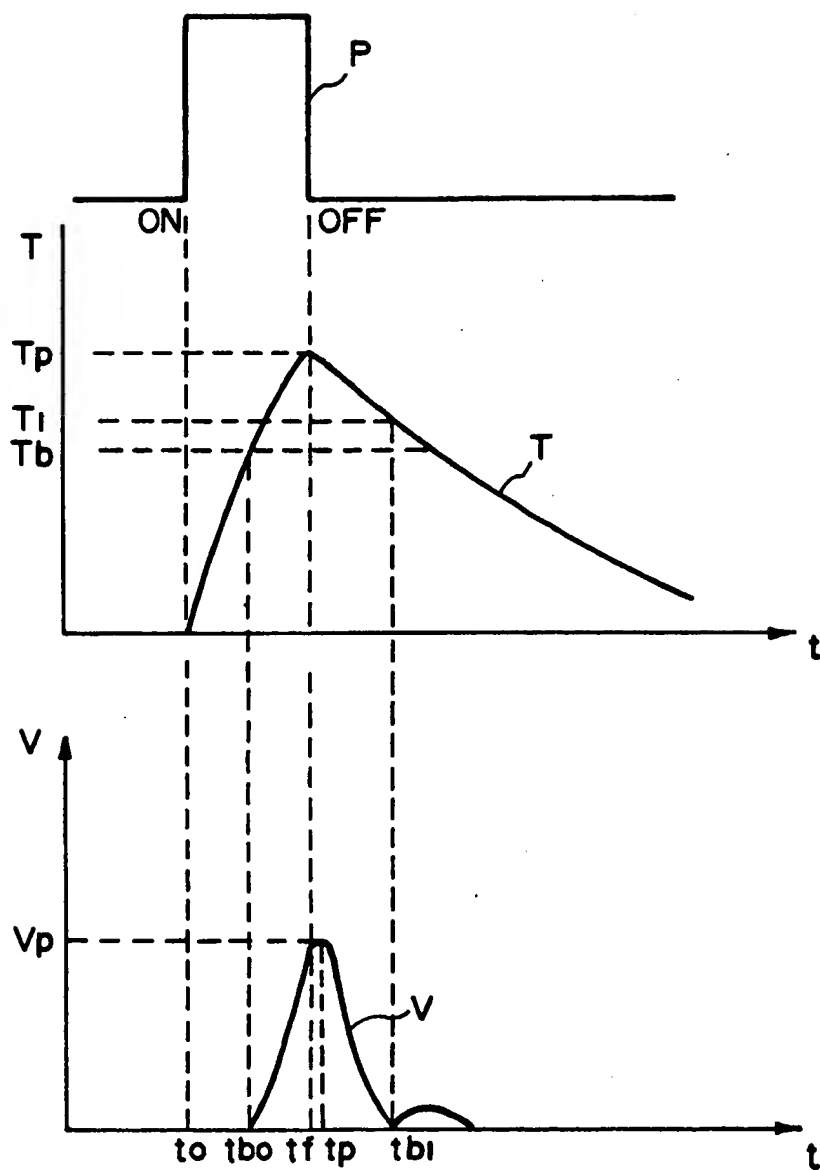


FIG. 2

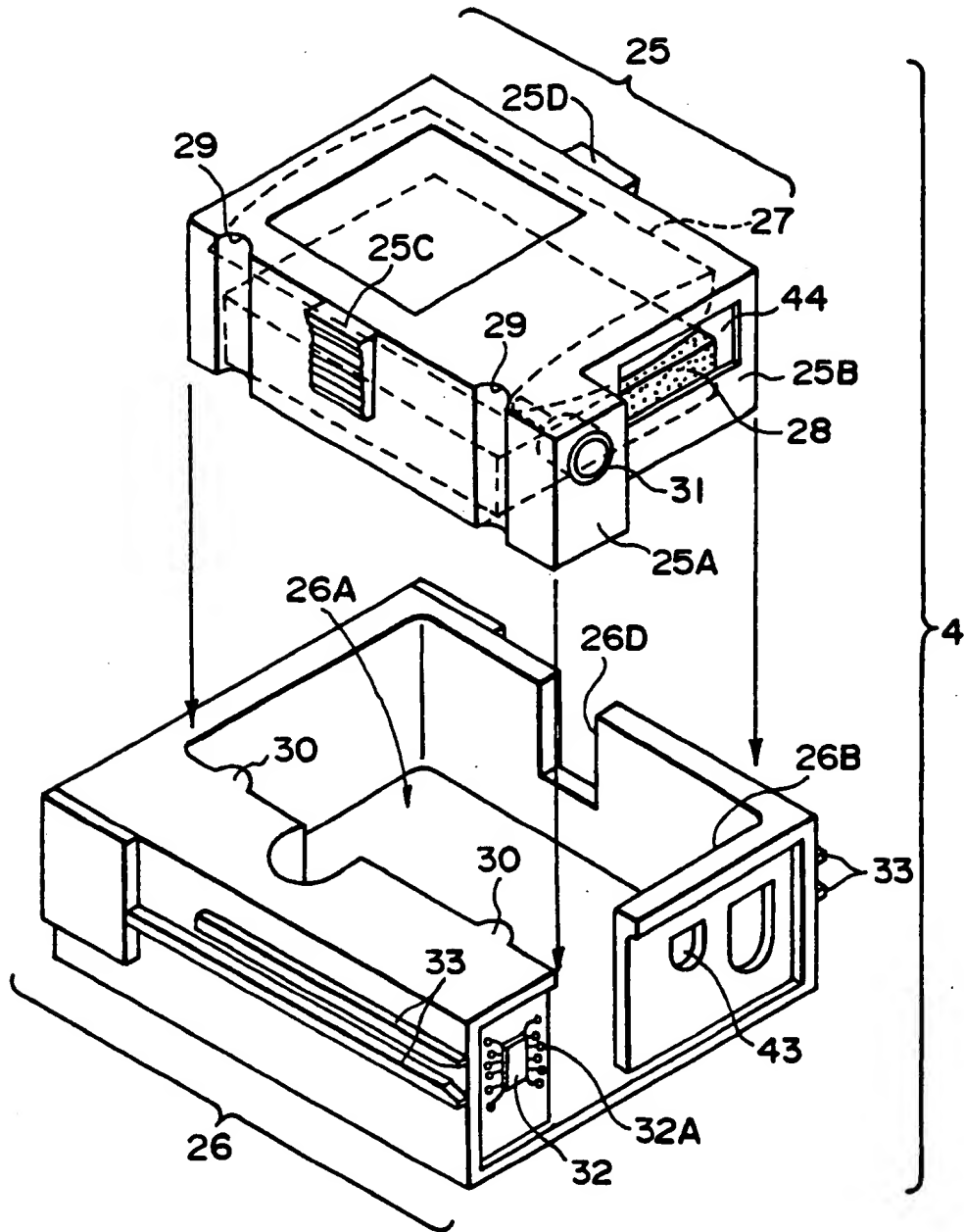


FIG. 4

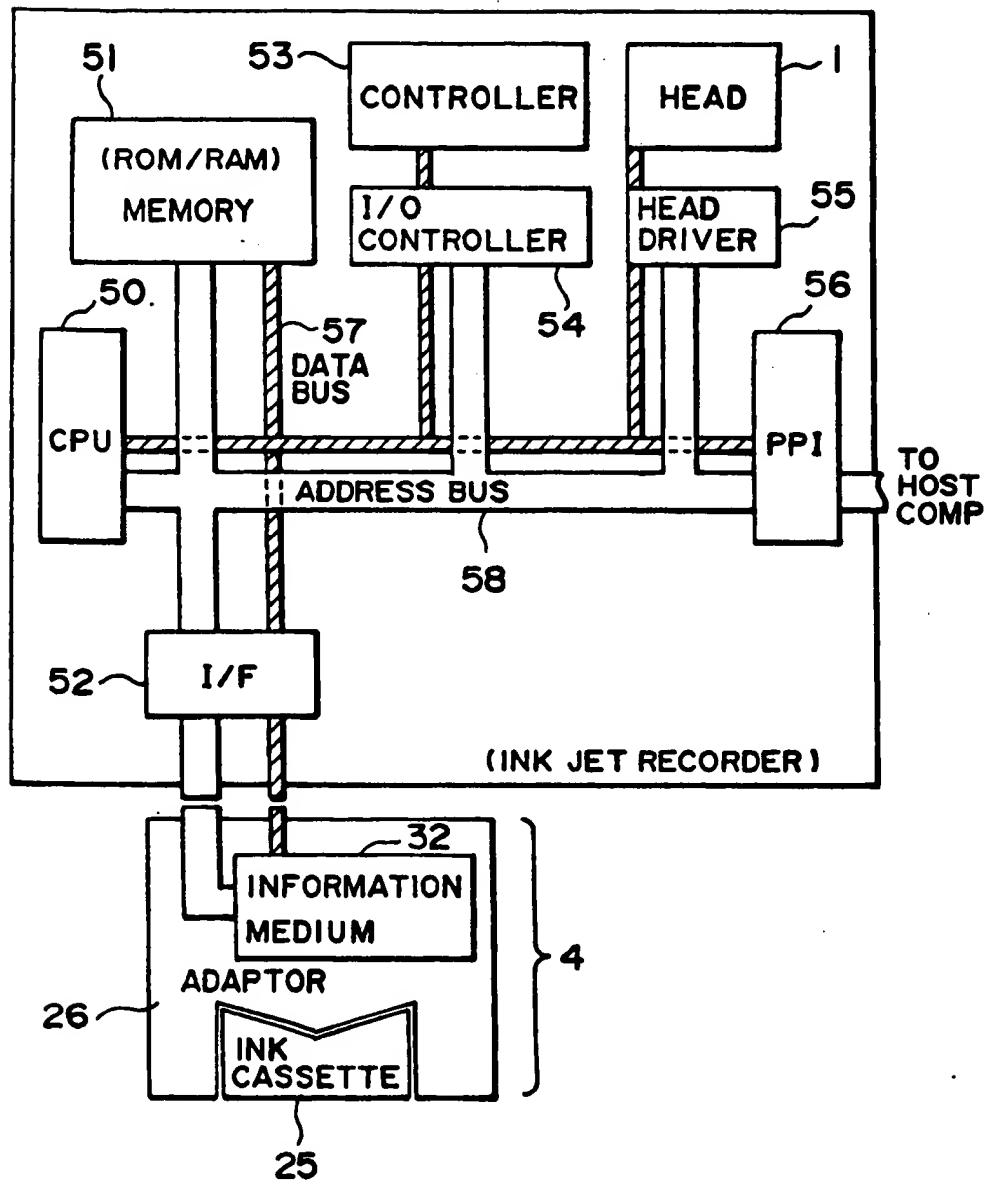


FIG. 6



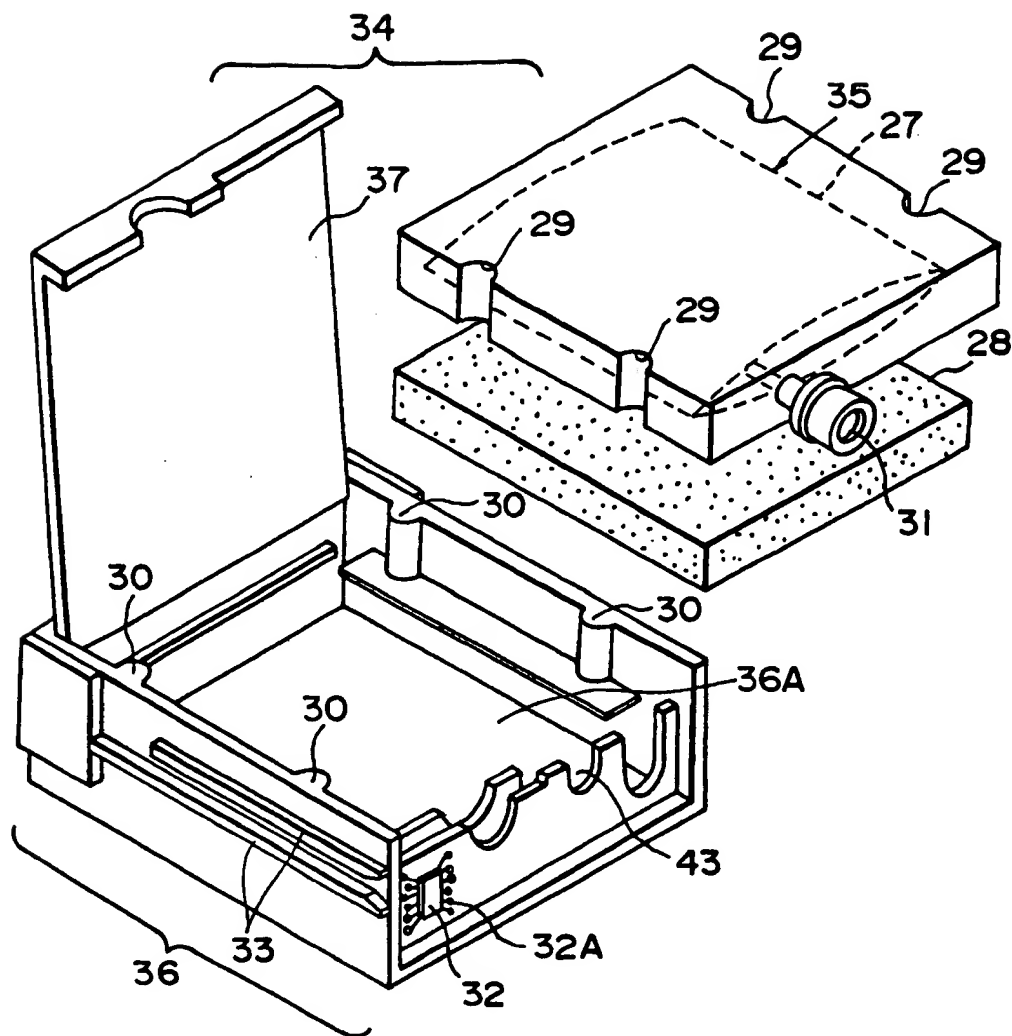


FIG. 8

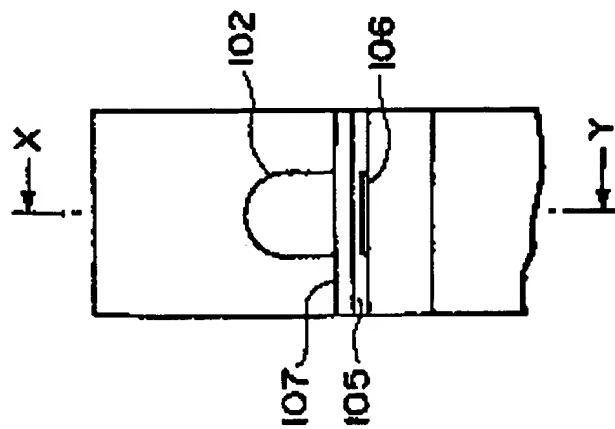


FIG. 1A

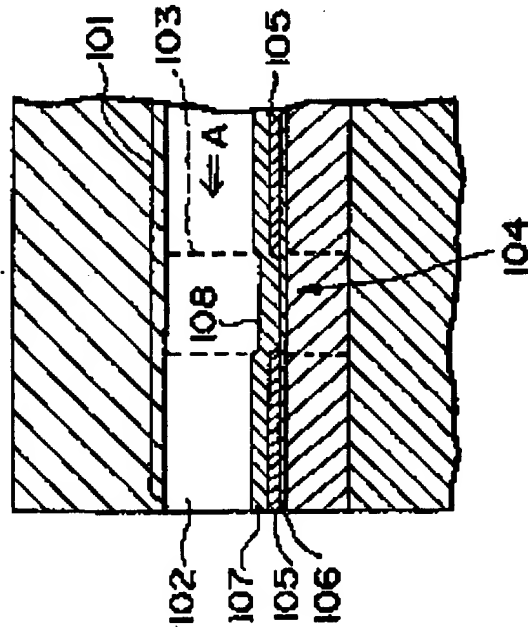


FIG. 1B

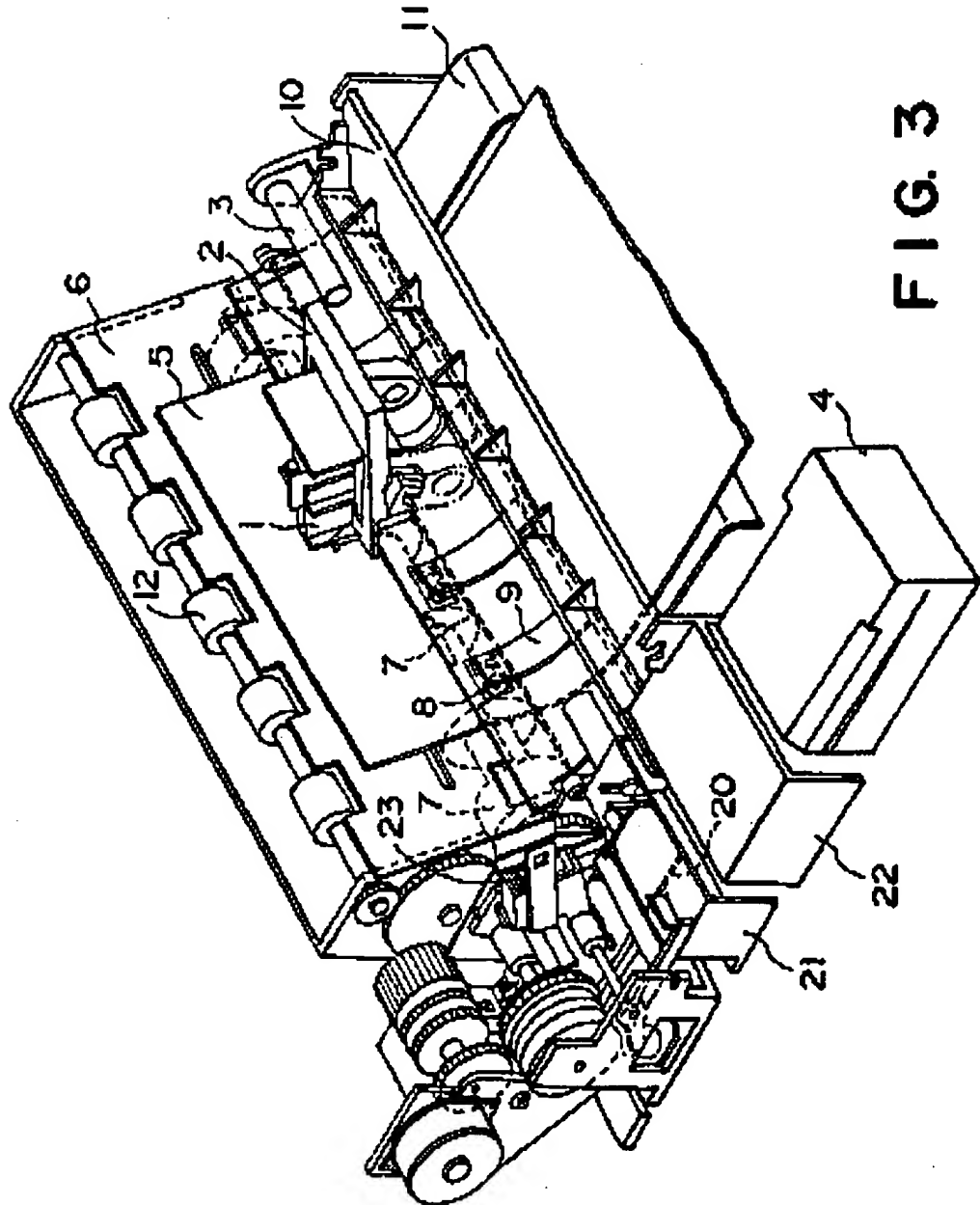


FIG. 3

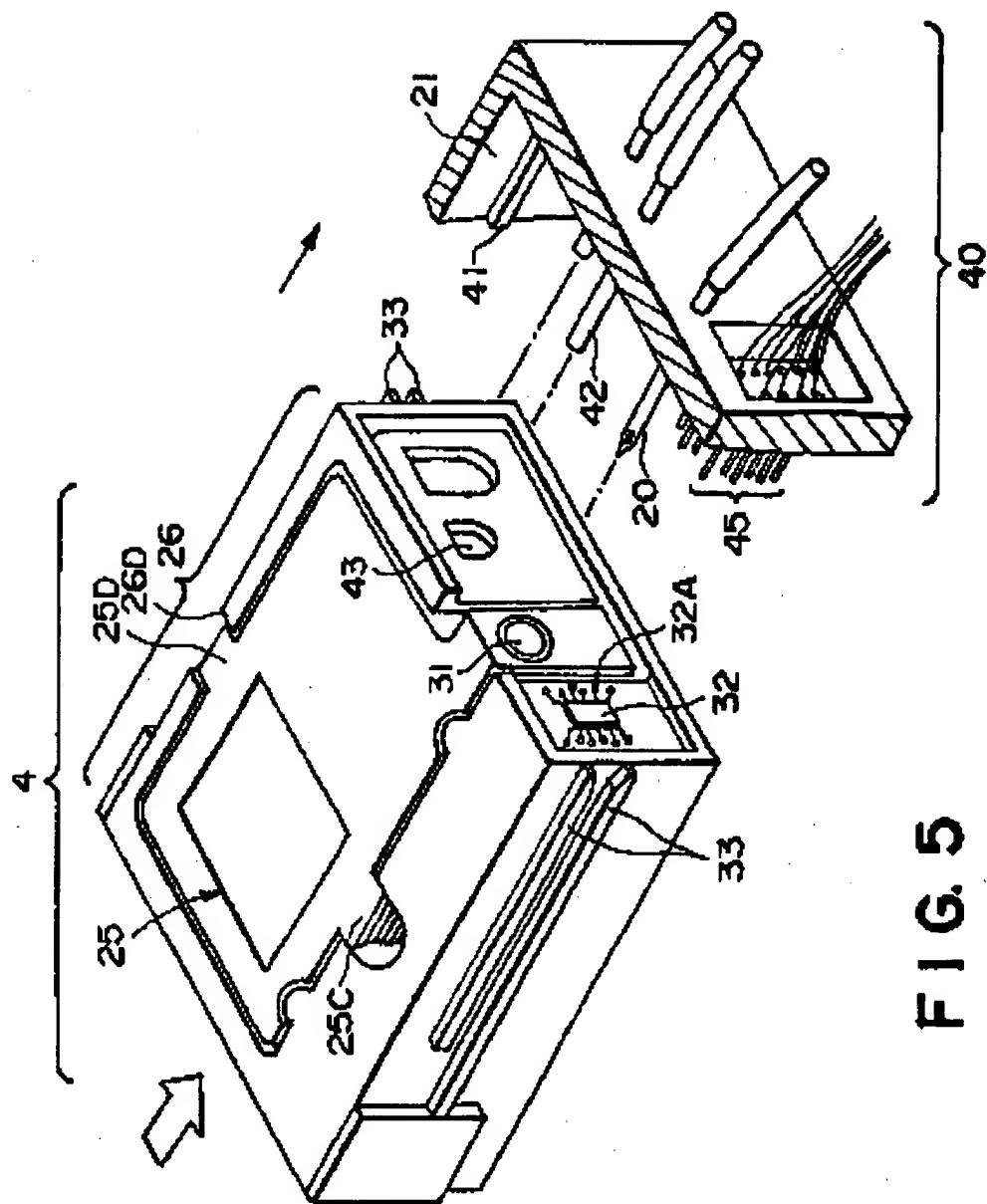


FIG. 5

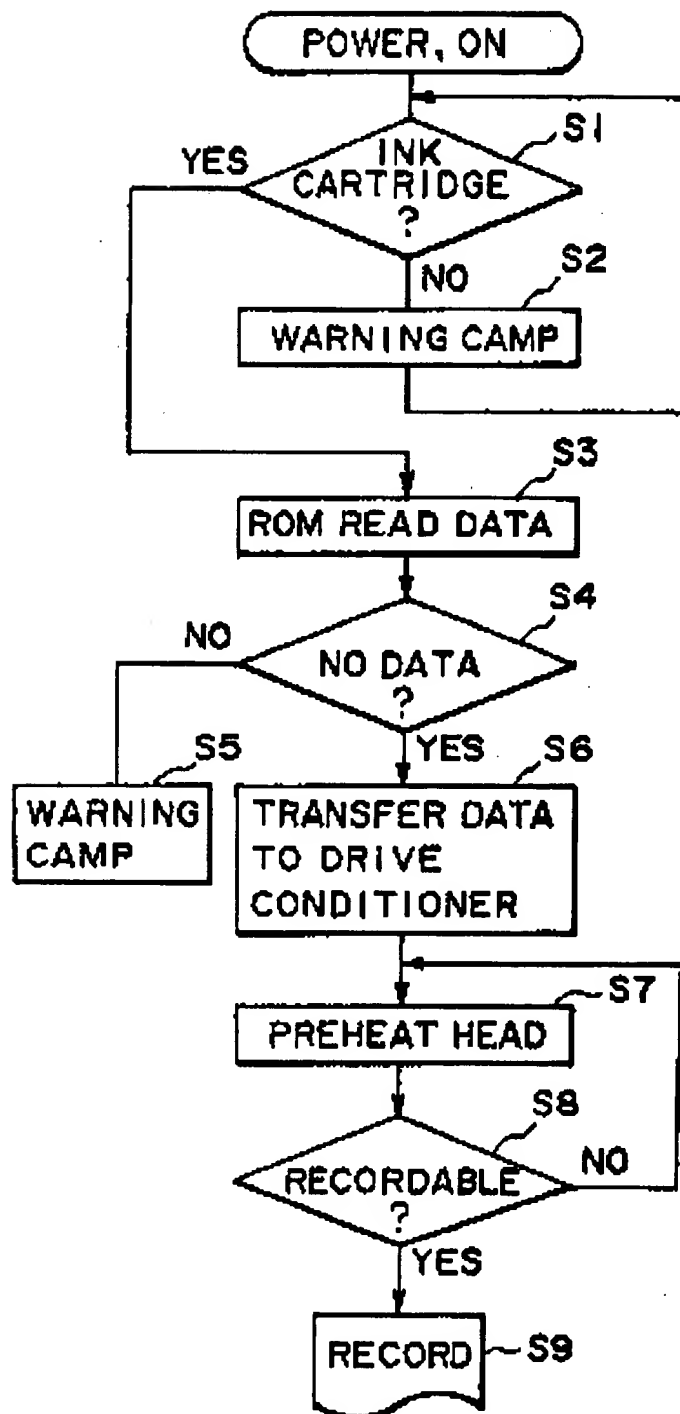


FIG. 7

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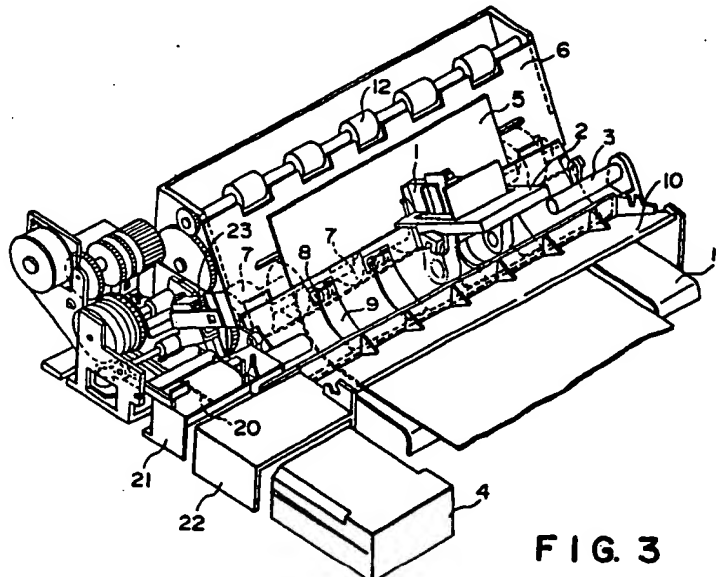
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(54) Ink jet apparatus and ink jet cartridge therefor.

(57) An ink cartridge (4) detachably mountable to an ink jet recording apparatus, the ink cartridge (4) containing ink to be supplied to a recording head (1) includes an ink container (25) for containing the ink; and an adaptor (26) having a receptor (26A) for

detachably receiving the ink container and an information medium (32) for storing information relating to the ink, the information being transmitted to the ink jet recording apparatus when the ink cartridge (4) is mounted therein.



**FIG. 3**

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